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Representations of restricted Lie algebras and families of associative $\mathfrak{L}$-algebras

Premet A., Skryabin S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Let $\mathfrak{L}$ be an n-dimensional restricted Lie algebra over an algebraically closed field K of characteristic p > 0. Given a linear function ξ on $\mathfrak{L}$ and a scalar λ ∈ K, we introduce an associative algebra $U_{\xi,\lambda}(\mathfrak{L})$ of dimension p^n over K. The algebra $U_{\xi,1}(\mathfrak{L})$ is isomorphic to the reduced enveloping algebra $U_\xi(\mathfrak{L})$, while the algebra $U_{\xi,0}(\mathfrak{L})$ is nothing but the reduced symmetric algebra $S_\xi(\mathfrak{L})$. Deformation arguments (applied to this family of algebras) enable us to derive a number of results on dimensions of simple $\mathfrak{L}$-modules. In particular, we give a new proof of the Kac-Weisfeiler conjecture (see [41], [35]) which uses neither support varieties nor the classification of nilpotent orbits, and compute the maximal dimension of simple $\mathfrak{L}$-modules for all $\mathfrak{L}$ having a toral stabiliser of a linear function.